INTERAGENCY AGREEMENT
BETWEEN
THE ARIZONA DEPARTMENT OF TRANSPORTATION
AND
THE ARIZONA BOARD OF REGENTS, UNIVERSITY OF ARIZONA

THIS AGREEMENT is entered into _____*March 5th*_____, 2003, between agencies of the State of Arizona, to wit; the ARIZONA DEPARTMENT OF TRANSPORTATION (the "State") and the ARIZONA BOARD OF REGENTS, acting for and on behalf of UNIVERSITY OF ARIZONA, (the "University")

I. RECITALS

1   The State is empowered by Arizona Revised Statutes Section 28-401 and 28-334 to enter into this agreement and has delegated to the undersigned the authority to execute this agreement on behalf of the State

2. The University is empowered by Arizona Revised Statutes Section 15-1626 to enter into this agreement and has delegated to the undersigned authority to execute this agreement on behalf of the University.

3. The State and the University desire to support the activities of a research project that will focus on improving existing procedures for identifying 'high-risk' crash sites in Arizona   By using the recently released *Arizona Local Government Safety Project Analysis Model (Carey, 2001)*, as a starting point, the focus will be on improving the predictions and ranking of hazardous sites from this model through a validation and recalibration effort

4.   The State will participate in the program, and provide funding in the amount of $61,776 00 the use and benefit of the University This agreement is to define the terms of the transfer of funds from the State to the University and the expenditure thereof

THEREFORE, in consideration of the mutual agreements expressed herein, it is agreed as follows:

II. SCOPE OF WORK

1. The State will:

a. Appoint a Project coordinator to interface with the University relating to the SPR 558 High Risk Crash Analysis.

b. Provide the University with information and data as may be reasonably available to assist in project research and development

c. Reimburse the University at one hundred percent (100%) of allowable and allocable costs of work performed directly relating to the SPR 558 High Risk Crash Analysis program within forty-five (45) days after receipt and approval of invoices reflecting the items defined as deliverables in Exhibit A, in a total reimbursement amount not to exceed $61,776.00. A payment report cover sheet is provided to the University (available electronically), when submitting pay requests. The State Project Manager, reserves the right to withhold payment of invoiced bills, if, in his judgment, the Project progress does not match the amount billed and, if the products developed as a part of the Project do not meet State quality standards.

2. The University will.

a. Appoint a Project coordinator at the University to interface with the State relating to the SPR 558 High Risk Crash Analysis program research and various project development

b. Accomplish the work generally in accordance with Exhibit A, which is attached hereto and made a part hereof, provide the State monthly, quarterly and final project reports and other deliverables as are defined in Exhibit A. Such reports will be in a format compliant with the State's Format for Research reports. University will provide its standard expenditure report as backup to its invoices

c. No more often than monthly, invoice the State (using the State's provided cover sheet), which will include all supporting documentation, in a total amount not to exceed $61,776.00

III. MISCELLANEOUS PROVISIONS

1. It is understood that neither party to this agreement agrees to indemnify the other party or hold harmless the other party from liability hereunder

2. This agreement shall become effective upon execution by the parties hereto and shall remain in force and effect until completion of SPR 558 High Risk Crash Analysis and reimbursements, provided, however, that this agreement, may be cancelled at any time prior to the commencement of performance under this agreement, upon thirty (30) days written notice to the other party

3. Title to all documents, reports and other deliverables prepared by the University in performance of this agreement shall rest jointly with the State and the University. In addition, the parties shall agree to the following.

- No information (data, findings or recommendations) shall be released without the express written consent of the State, and require the same of any contractor(s)
- Project confidentiality will be maintained throughout the Project.

- The final report, a public document, will be released no more than sixty days after its acceptance and approval by the Steering Committee, upon written consent of the State.

4. The parties agree to comply with all applicable state and federal laws, rules, regulations and executive orders governing procurement, equal employment opportunity, immigration, nondiscrimination and affirmative action

5. This agreement may be cancelled in accordance with Arizona Revised Statutes Section 38-511

6. The provisions of Arizona Revised Statutes Section 35-214 are applicable to this contract

7. In the event of any controversy which may arise out of this agreement, the parties hereto agree to abide by required arbitration as is set forth for public works contracts in Arizona Revised Statutes Section 12-1518.

8. All notices or demands upon any party to this agreement relating to the agreement shall be in writing and shall be delivered in person or sent by mail addressed as follows:

Arizona Department of Transportation   Arizona Department of Transportation
Joint Project Administration   Transportation Planning Division
205 S. 17th Avenue - 616E   206 South 17 Avenue, Mail Drop 300B
Phoenix, AZ 85007   Phoenix, AZ 85007

Technical:
University of Arizona
Simon Washington, Ph.D
P. O. Box 210072
Tucson, AZ 85721-0072

Administrative:
University of Arizona
Tucson, AZ 85722-3308
Payments mailed to: University of Arizona, P. O. Box 44390, Tucson, AZ 85733-4390

9. The parties recognize that performance by the University under this Agreement may be dependent upon the appropriation of funds by the U.S. Department of Transportation, Federal highway Administration. Should the government at any time fail to assign the necessary funds for such performance, the State or the University may cancel this agreement
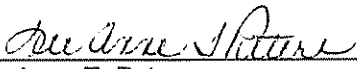
10. Should the work contemplated under this agreement be completed at a lower cost than the maximum amount, or for any other reason should any of these funds not be expended, a proportionate amount of the funds provided shall be reimbursed to the State

IN WITNESS WHEREOF, the parties have executed this agreement the day and year first above written

STATE OF ARIZONA

THE ARIZONA BOARD OF REGENTS
acting for and on behalf of
THE UNIVERSITY OF ARIZONA

DEPARTMENT OF TRANSPORTATION

By _____
     LeeAnne T Peters
     Contract Officer

By _____
     DALE BUSKIRK, Acting Division Director
     Transportation Planning Division

_____2/12/03_____
(date)

_____2/25/03_____
(date)

G: AZ UofA High Risk Crash Analysis
27 Jan2002-jw

2002 TRAFFIC & SAFETY RESEARCH (FY 03)
HIGH-RISK CRASH SITE IDENTIFICATION IN ARIZONA
Application of State-of-the-Practice Methods for "Hot-Spot" Identification

Problem Statement (3) – University of Arizona

Identification of high-risk crash sites is a difficult task and has received much attention in the literature. Because of the random fluctuation of crashes from year to year, a crash site may 'appear' to represent a relatively high risk in a given year when in fact the site's underlying, inherent risk level is average or below (Hauer, 1997, Observational Before After Studies in Road Safety, Pergamon; Persaud, 1986, Safety Migration, the Influence of Traffic Volumes, and Other Issues in Evaluating Safety Effectiveness, TRR 1086, National Academy of Sciences).

Previous methods rely on simple ranking of crash rates, which is problematic since rates are not linear functions. This can produce false positive indications and may lead to fixing of safety problems at locations not requiring remediation. Corrections to this 'regression to the mean' bias are often needed to account for the temporal fluctuation in crashes from year to year. Bayesian techniques, by accounting for both crash history and expected crashes for similar sites, have been shown to offer improved ability to identify 'high-risk' sites.

Many DOT's face significant liabilities associated with high-risk site identification and subsequent safety improvements. Because state-of-the-practice methods involve corrections for regression to the mean through Bayesian analysis, and since traditional ranking methods have been shown to do a poor job of identifying the truly high-risk sites, there is a significant need for this research.

This research project will focus on improving existing procedures for identifying 'high-risk' crash sites in Arizona. By using the recently released *Arizona Local Government Safety Project Analysis Model* (Carey, 2001) as a starting point, the focus will be on improving the predictions and ranking of hazardous sites from this model through a validation and recalibration effort.

Through this research, ADOT will obtain the following benefits:
1. Identification of 'high-risk' locations on ADOT facilities (to be selected by ADOT).
2. Suggested modifications to the Arizona Local Government Safety Project Analysis Model.
3. Validation and recalibration of the *Arizona Local Government Safety Project Analysis Model* for ensuring that efficient safety investments are made in Arizona.

Research Objectives
There are three separate but related research objectives:

1. To validate the predictive performance of the *Arizona Local Government Safety Project Analysis Model* (*the Model*) for identifying 'high –risk' locations through the use of real data collected in the State of Arizona and through the use of simulated data (i.e. experiments).
2. Based on results of the model validation, implement enhancements to *the Model* to better account for the regression to the mean effect and perhaps other as yet unidentified effects.
3. Provide recommended improvements to *the Model*, so as to enable future enhancements to the software code to ensure that efficient safety investments are made in Arizona.

Research Tasks

1) **Identification of Sites with Promise: Literature and Model Review:** The research team will review the literature to identify state-of-the-practice in high-risk site identification. Then, *the Model's* analytical core will be reviewed and inspected to identify opportunities for possible enhancements leading to improved prediction (e.g. it currently does not perform a Bayesian correction for regression to the mean, see pp. 47). The product of this task will be a comprehensive literature review documenting the current state-of-the-practice methods for identifying sites with promise, and a detailed review of how *the Model* analytical components compare to this process. The research team will submit the literature review to ADOT for review and comment.

2) **Model Validation:**
   a) Quantify the predictive performance of *the Model* using real data from Arizona, and enlist support for this activity from current *Model* users.
   b) Quantify the predictive performance of *the Model* using simulated crash data. This will provide controlled "tests" of the model using known properties of how "sites with promise" behave statistically.

   This research task will serve as a comprehensive validation of *the Model* as it currently is configured and implemented through its software interface. Thus, it will quantify its ability to adequately and accurately identify sites with promise both with respect to field data (where sites with promise may not be known with certainty) and with respect to simulated data (where sites with promise will be known but where data many not entirely emulate real conditions). The real data will be obtained from current *Model* users in Arizona in a retrospective application. Simulated data will correspond with a designed experiment that will vary field levels such as degree (or percentage) of difference between "correctable" and "average" sites, variability in the data, and different assumed crash distributions, such as negative binomial and Poisson mixtures in a way that will isolate their individual effects.

3) **Model Recalibration:** Using the results of steps 2a and 2b, the research team will identify potential analytical improvements to *the Model*, so that future identification of 'high-risk' sites will be improved. Thus, specific analytical enhancements to the model will be identified that can be used to improve the performance of the model in identifying sites with promise. In addition, the research team shall coordinate with and convey the technical improvements to Jason Carey so that the technical

refinements and enhancements can be accomplished within ADOT SPR 547 through software improvements the end result shall be improved capability with *the Model* as reflected by work conducted in this study and SPR 547.

4) **Draw Conclusions, Make Recommendations, and Prepare Report:** The research team will prepare a set of recommendations to the TAC on the benefits and/or improvements of *the Model*, and identify opportunities in the model where and when these improvements could be implemented. The research team will prepare a project summary report for ADOT and present the research results.

Project Duration, Timeline, and Budget:

Project overall duration is estimated at 18 months. The desired start time, selected to coincide with the academic calendar, is January 2003. The total budget is estimated at $61,776. The timeline of milestones and deliverables is:

Task *(Deliverable)*	*Start* *Time* *to* *Completion*
Task One--Lit/Model Review: *review*)	5 months *(Report on findings of Lit. review)*
Task Two: Model Validation: *Model*	11 months *(Report on Results of Model Validation and present results to*
TAC)	
Task Three: Model Recalibration: *to*	16 months *(Summary findings report Model recalibration)*
Task Four: Draft Final Report/Final Report:	16 months *(Draft report)* 18 months *(Final report and present results to TAC)*

Electronic quarterly progress reports shall be submitted starting March 20th, 2003 and quarterly thereafter.

Budget:

High-Risk Site Identification in Arizona		Time* (%) Over Contract	Hours Spent on Task					Hourly	
Name of Staff Member	Role in Study		Task 1	Task 2	Task 3	Task 4	Totals	Rate (S)	Cost (S)
University of Arizona									
Simon Washington. Ph D	Principal Investigator	9%	25	80	80	80	265	S51 89	S13,751
Jutaek Oh. Ph.D.	Post Doctoral Researcher	7%	10	80	40	80	210	S19 85	S4,169
Graduate student	Graduate Student Researcher II	34%	100	300	300	300	1000	S25.07	S25,070
	Totals:		135	460	420	460	1475		$42,989

* (Percent Time) = Total Hours / (174 hours per month) / (14 months work)

			Task 1	Task 2	Task 3	Task 4	Totals
		University of Arizona					
a)	Salaries and Wages		S4,003	S13,260	S12,466	S13,260	S42,989
b)	Capital Equipment		S0	S0	S0	S0	S0
c)	Materials and Supplies		S500	S1,500	S500	S500	S3,000
d)	Communications and Shipping		S100	S100	S100	S150	S450
e)	Travel		S500	S1,000	S500	S1.000	S3.000
f)	Faculty/Staff Payroll Benefits	19 40%	S290	S1,113	S959	S1,113	S3,476
g)	Graduate Student Payroll Benefits	3.20%	S80	S241	S241	S241	S802
h)	Overhead	15.00%	S821	S2,582	S2,215	S2,440	S8,058
I)	Direct Costs		S5,473	S17,214	S14,766	S16,264	S53.718
	Total Costs requested from ADOT		$6,294	$19,796	$16,981	$18,704	*$61,776*

OFFICE OF THE ATTORNEY GENERAL
STATE OF ARIZONA

CIVIL DIVISION
TRANSPORTATION SECTION
WRITER'S DIRECT LINE: 602.542.8855
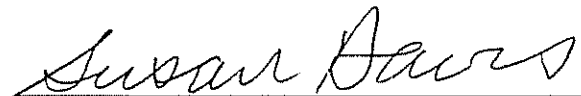
TERRY GODDARD
ATTORNEY GENERAL

INTERGOVERNMENTAL AGREEMENT
DETERMINATION

A.G. Contract No. KR03-0144TRN (JPA 02-210), an Agreement between public

agencies, has been reviewed pursuant to A.R.S. § 11-952, as amended, by the Undersigned

Assistant Attorney General who has determined that it is in the proper form and is within the

powers and authority granted to the State of Arizona.

No opinion is expressed as to the authority of the remaining Parties, other than the

State or its agencies, to enter into said Agreement.

DATED March 5, 2003.

TERRY GODDARD
Attorney General

Susan Davis

SUSAN E. DAVIS
Assistant Attorney General
Transportation Section

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att.